Subsidence Documentation Study
Sufco Mine
May 30, 2003
Summary

The data contained in this binder is a compilation of subsidence features gathered in the field from the 19 of May to the 22 of May 2003. The features have been organized into five different sections representing panels in descending order starting with the most recent. At the beginning of each section is a summary sheet outlining important aspects of the panel with emphasis on subsidence features contained therein.

Documented feature numbers correspond numerically to points on the Arcview map contained in this binder. It is important to note that the numbers depicted in the photos DO NOT CORRESPOND to documented features, and were only used to keep photos organized for later reference.

Subsidence Documentation Study
Summary Sheet

Mine Name: Sufco **Mine Number** C/041/002

Panel: 1 left pines east

Feature #'s: 2, 3, 4, 7, 8, 9, 13

Date of Mining: August 2002 to Present

Describe the mining that took place in this area (methods, multiple seams,)
Longwall mining

Subsidence Survey (methods and dates, date of subsidence):
To date, no subsidence surveys on this panel have been documented. Photos were taken prior to mining in this region in order to compare to photos taken later after subsidence occurred.

Describe the amount and type of subsidence reported in the Annual Report (provide reference to year)
Annual report provides no current subsidence information on this panel.

Depth of Overburden (both seams):
Between 900 and 1100 feet.

Does any subsidence feature on this panel require mitigation? If so describe.
Features 2, 4, and 7 should be watched and monitored at a later date to ensure that healing is underway and show no signs of worsening to the point of becoming a hazard.

P:\GROUPS\COAL\WP\TEAMS\Subsidence\summary_sheet.doc

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 19 May 2003

Panel: 1 left pines east **Feature #** 2

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Trough Escarpment Spalling

Elevation: 8380 feet **Slope:** ~50 degrees

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall,) low, (medium), Trees (deciduous, (evergreen)

GPS Coordinates: N4317501m
E471108m

Dimensions (in feet): 54 feet long
10 inches wide in places
more than 4 feet deep in places

Potential Hazards? Crack is large & is wide enough to easily step into in places.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, leave alone, (watch?)):
Seems to be healing in places but may need mitigation in the future.


5/19/2003


5/19/2003


5/19/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 19 May 2003

Panel: 1 left pines east **Feature #** 3

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Cracks) Sinkhole Trough Escarpment Spalling

Elevation: 8375 feet **Slope:** ~50 ~~degrees~~ % grade

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall) (low) (medium), Trees (deciduous) (evergreen)

GPS Coordinates: N4317597m
E470960m

Dimensions (in feet): Cracks form in parallel and then are displaced by as much as 4 feet of offset in a step-like formation. This stepping pattern covers a large swath of ground approximately 300 feet long by 250 feet wide.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, (healing), leave alone, (watch?)):
Plants appear to be adapting well to the soil movement, & new grass is growing over displaced soil.


5/19/2003


5/19/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 19 May 2003

Panel: 1 left pines east **Feature #** 4

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Trough Escarpment Spalling

Elevation: 8375 feet **Slope:** ~50 ~~degrees~~ % grade

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass/Forbes) (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

GPS Coordinates: N4317597m
E470960m

Dimensions (in feet): Crack is 240 feet long, and as wide as 9 inches in places. Immediate depth varies between 3 and 12 inches.

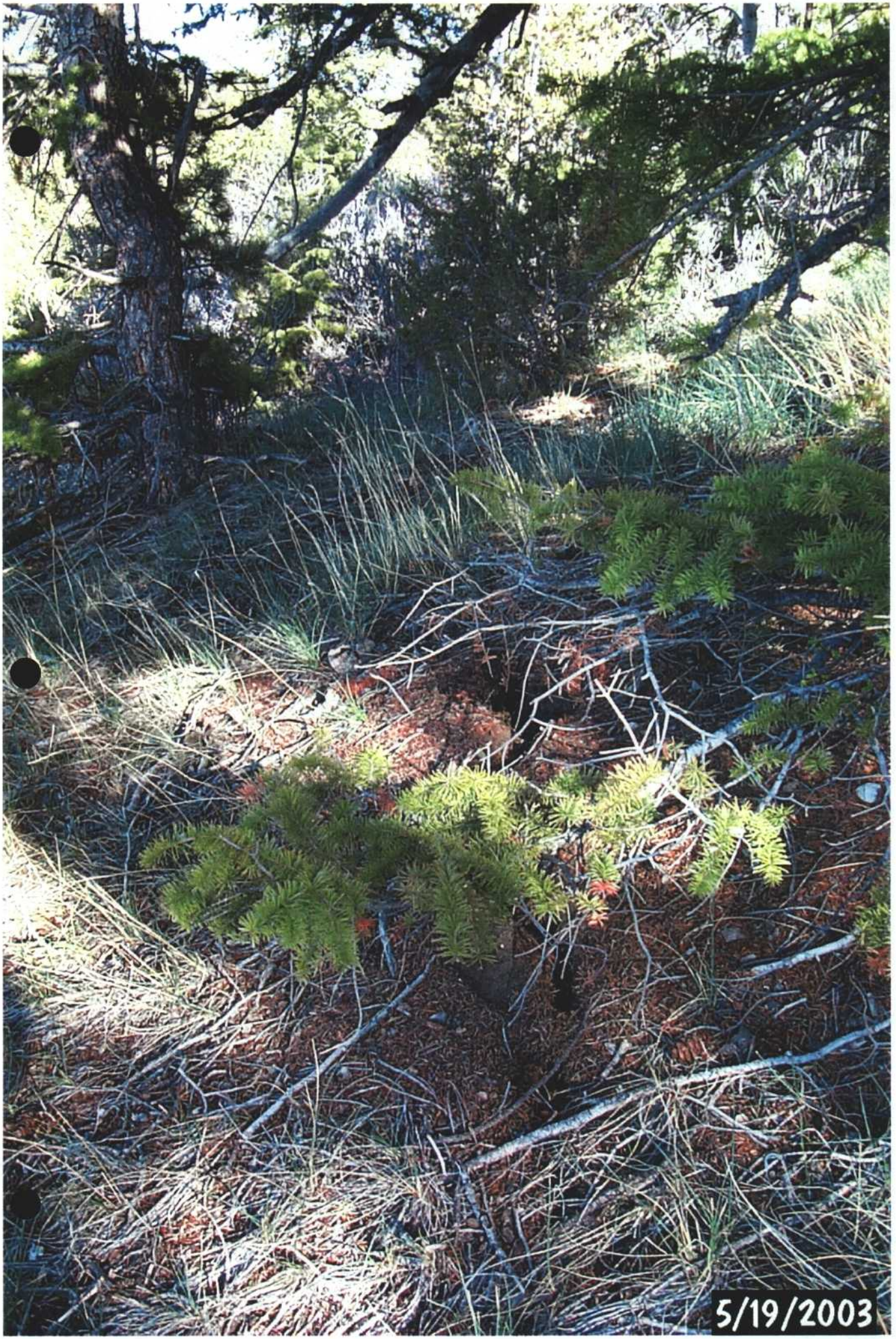
Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, leave alone, (watch?)):
This crack is quite large, and should be watched. If it should grow any larger it may become a hazard. Some areas appear to have healed.


5/19/2003


5/19/2003


5/19/2003


5/19/2003


5/19/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: 1 left pines east **Feature #** 7

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Trough Escarpment Spalling

Elevation: 8428 feet **Slope:** ~10 degrees

Type of Ground (circle one) - Rock (Soil)

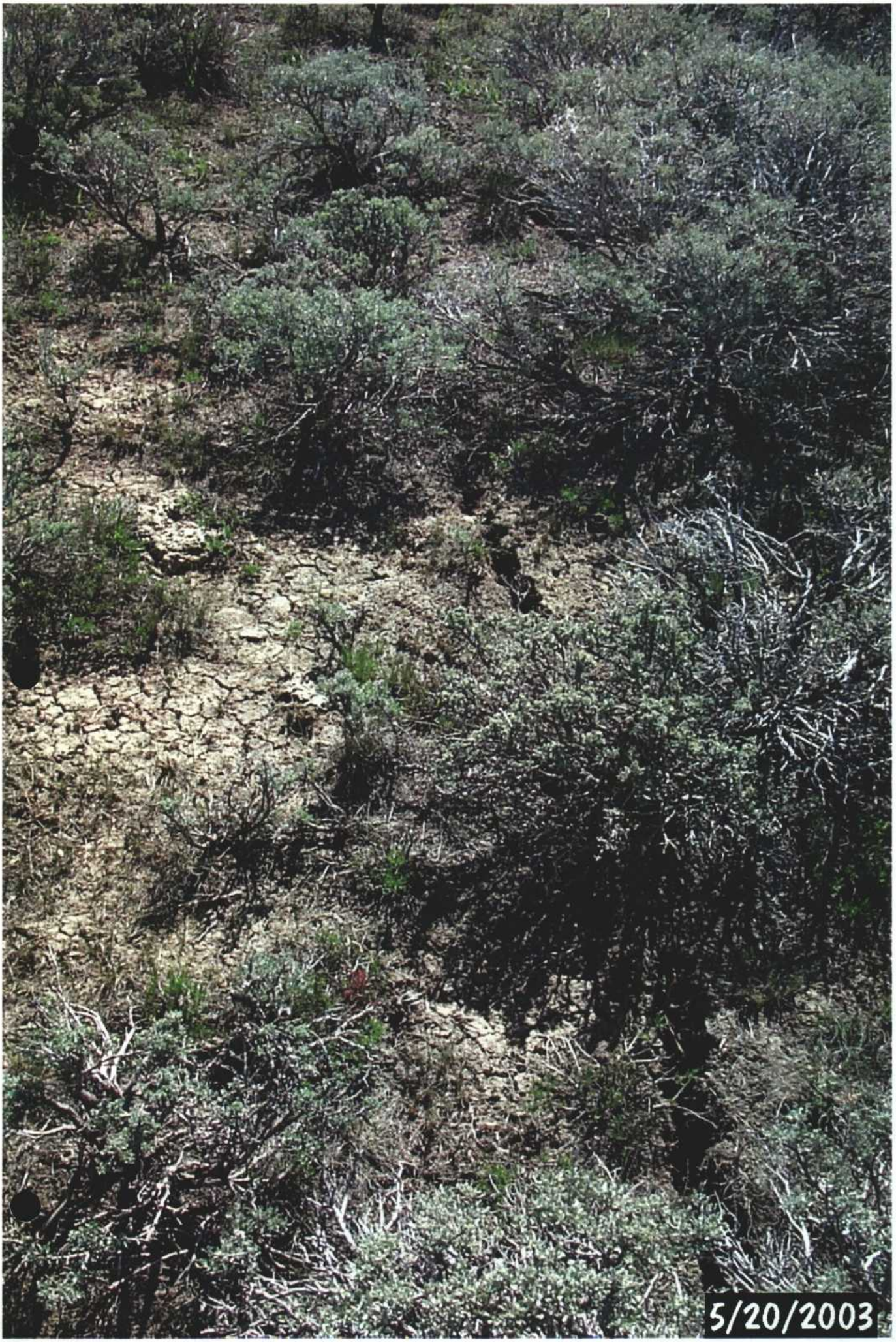
Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall, (low,) medium), Trees (deciduous, evergreen)

GPS Coordinates: N4315928m
E470927m

Dimensions (in feet): This crack is 116 feet long and up to 8 inches wide. Appears quite deep in places.

Potential Hazards? Since this crack is in the heart of grazing land, it may be a hazard to cattle.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, leave alone, (watch?)):


5/20/2003


5/20/2003


5/20/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: 1 left pines east **Feature #** 8

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Trough Escarpment Spalling

Elevation: 8373 feet **Slope:** ~10 degrees

Type of Ground (circle one) - Rock (Soil)

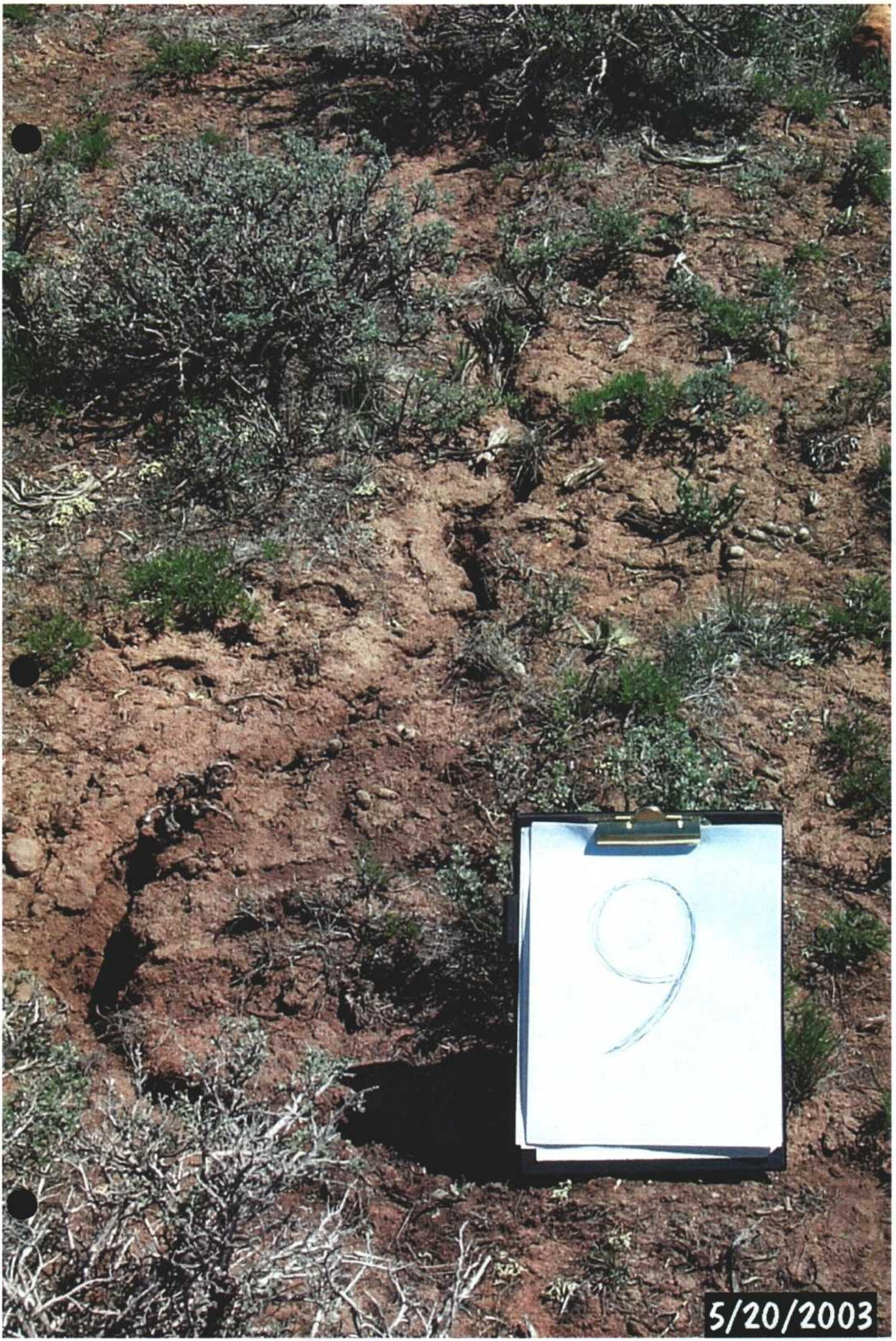
Vegetative Ground Cover (circle all that apply) - Grass/Forbes (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

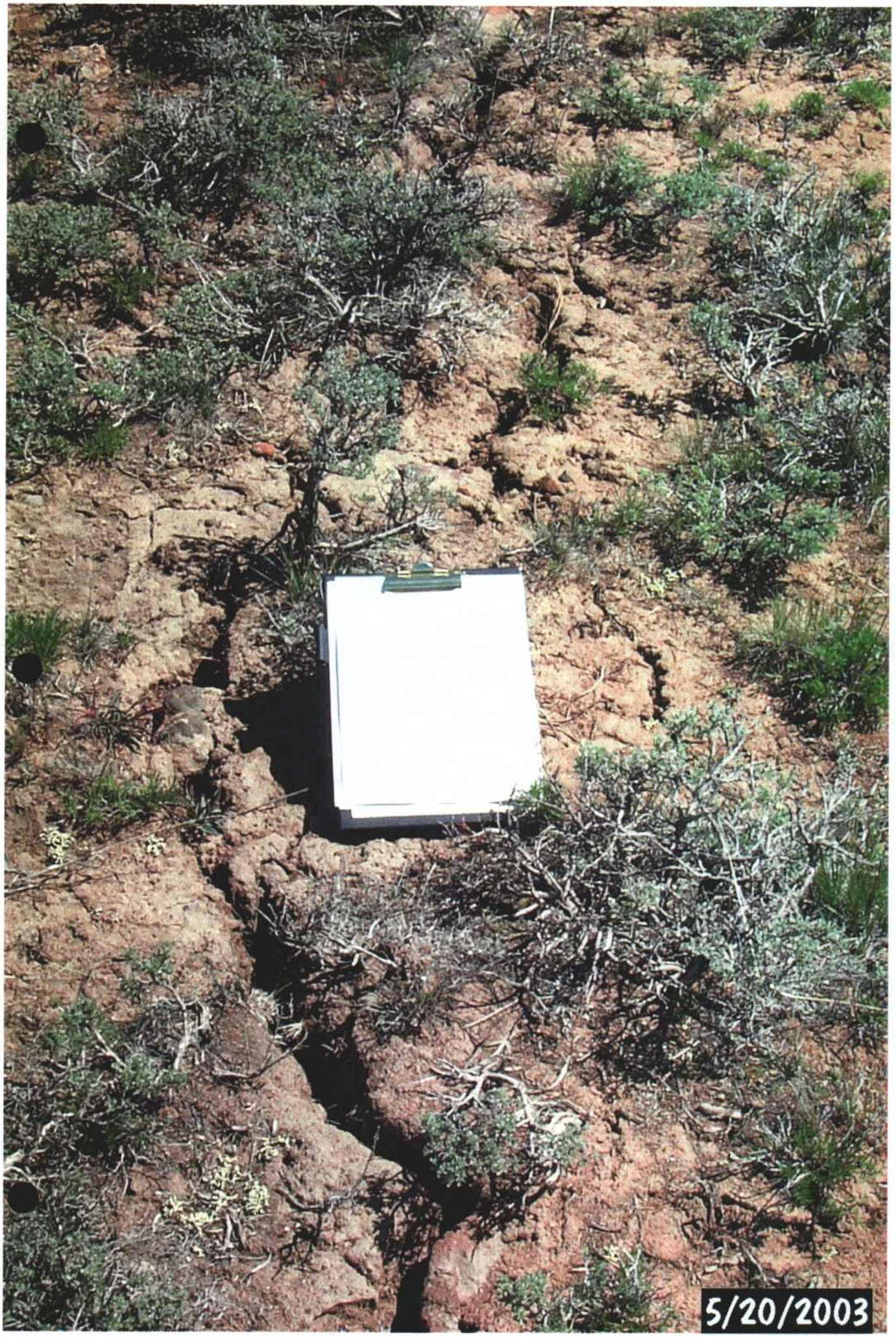
GPS Coordinates: N4317077m
E470722m

Dimensions (in feet): This crack is 225 feet long and up to 6 inches wide. Depth varies from a few inches to over a foot.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, (healing), leave alone, watch?):
This crack is similar to feature #7 however appears to be healing along entire length.


5/20/2003


5/20/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: 1 left pines east **Feature #** 9

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Trough Escarpment Spalling

Elevation: 8355 feet **Slope:** ~5 degrees

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall (low) medium), Trees (deciduous, evergreen)

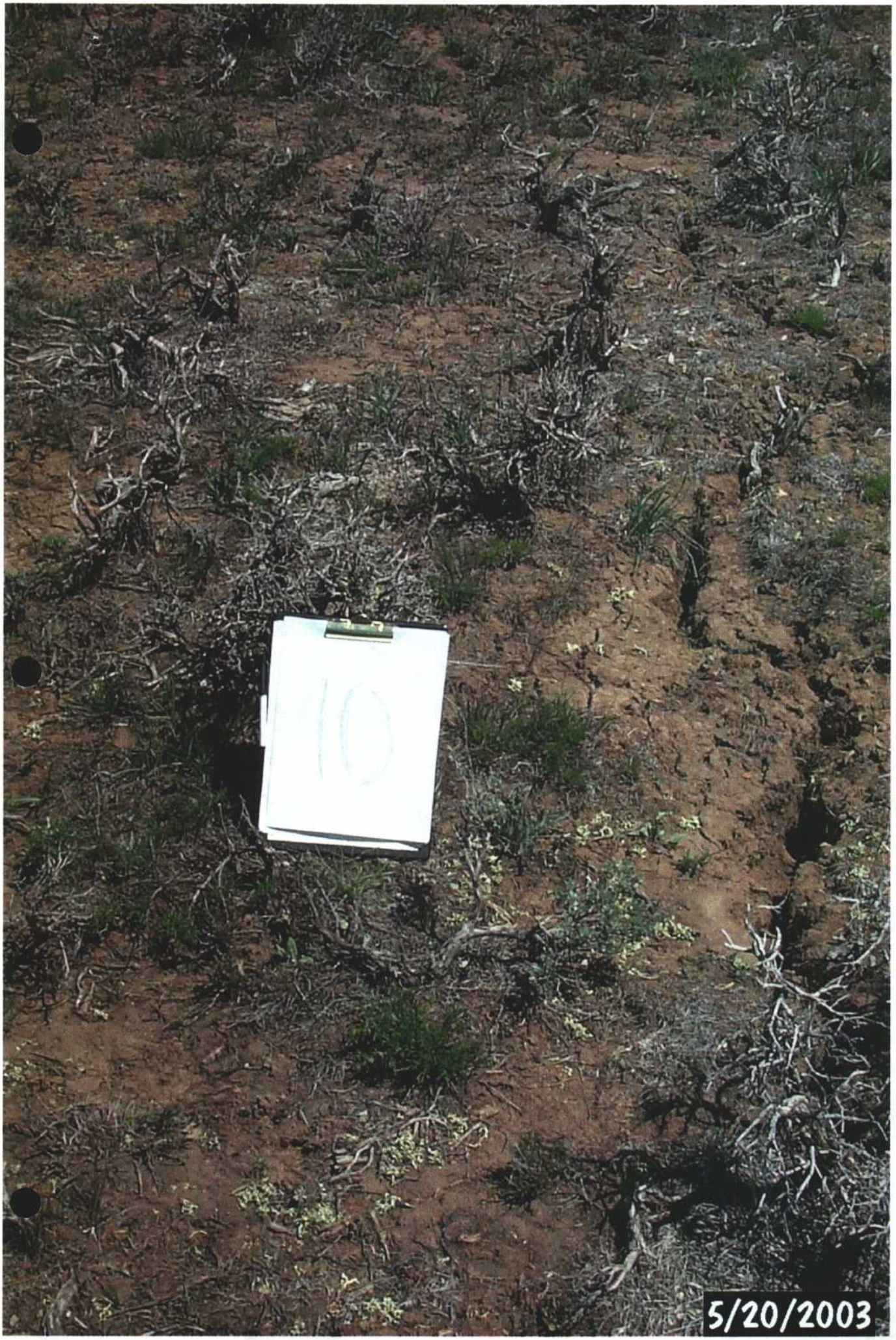
GPS Coordinates: N4317111m
E470712m

Dimensions (in feet): This crack is approximately 300 feet long. Depth and width varies between 2 and 8 inches.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, (healing), leave alone, watch?):
This feature is actually a series of cracks running end-to-end, which gives the impression that this used to be one continuous crack at one point. The healing process has closed this crack off in many places.


10
5/20/2003


10
5/20/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: 1 left pines east **Feature #** 13

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8480 feet **Slope:** none

Type of Ground (circle one) - (Rock) Soil

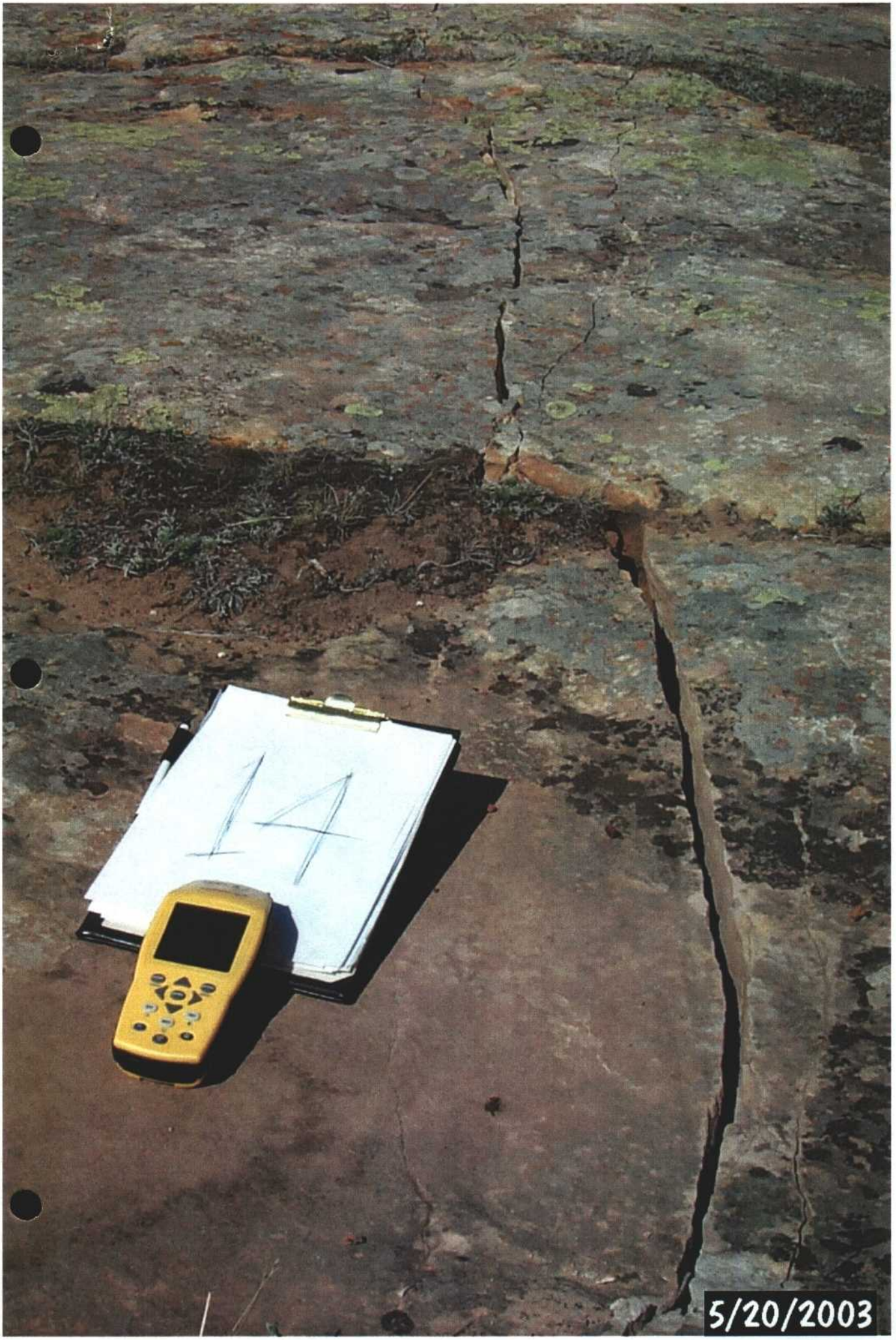
Vegetative Ground Cover (circle all that apply) - Grass/Forbes (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

GPS Coordinates: N4314098m
E470660m

Dimensions (in feet): This crack is 101 feet long, and up to 1 inch wide.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, (leave alone) watch?):


14
5/20/2003

Subsidence Documentation Study
Summary Sheet

Mine Name: Sufco **Mine Number** C/041/002

Panel: pines bleeder

Feature #'s: 5, 6, 10, 11, 12, 15, 16, 18, 19, 20, 27, 28, 29, 30, 31

Date of Mining: September 2001 to August 2002

Describe the mining that took place in this area (methods, multiple seams,)
Gateroad development began in January 1999 in area 11; Longwall mining began in May 2000 through August 2001 (completing mining in both areas 10 and 11).

Subsidence Survey (methods and dates, date of subsidence):
This panel demonstrates a vertical displacement of up to 5 feet. These measurements were recorded using current photogrammetric monitoring. This area is considered an "active" subsidence area as displacement may still be occurring.

Describe the amount and type of subsidence reported in the Annual Report (provide reference to year)
Surface depressions are documented along entire length of panel, as reported in the 2001 Annual Report. Tension cracks are not reported.

Depth of Overburden (both seams):
Between 900 and 1300 feet.

Does any subsidence feature on this panel require mitigation? If so describe.
Features 16 and 18 should be watched and monitored at a later date to ensure that healing is underway and show no signs of worsening to the point of becoming a hazard. Feature 18 in particular is quite large, and no doubt will take a long time to heal on its own. Mitigation should be considered if the crack widens further.

P:\GROUPS\COAL\WP\TEAMS\Subsidence\summary_sheet.doc

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 19 May 2003

Panel: pines bleeder **Feature #** 5

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Trough Escarpment Spalling

Elevation: 8431 feet **Slope:** ~15 ~~degrees~~ % grade

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass)/Forbes (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

GPS Coordinates: N4317611m
E470734m

Dimensions (in feet): This is a series of three cracks all averaging 20 feet in length. Average depth is about 3 inches, and average width is also 3 inches.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, (healing), (leave alone), watch?):
These cracks are healing, and are almost completely filled in.


5/19/2003


5/19/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 19 May 2003

Panel: pines bleeder **Feature #** 6

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Trough Escarpment Spalling

Elevation: 8363 feet **Slope:** none

Type of Ground (circle one) - (Rock) Soil

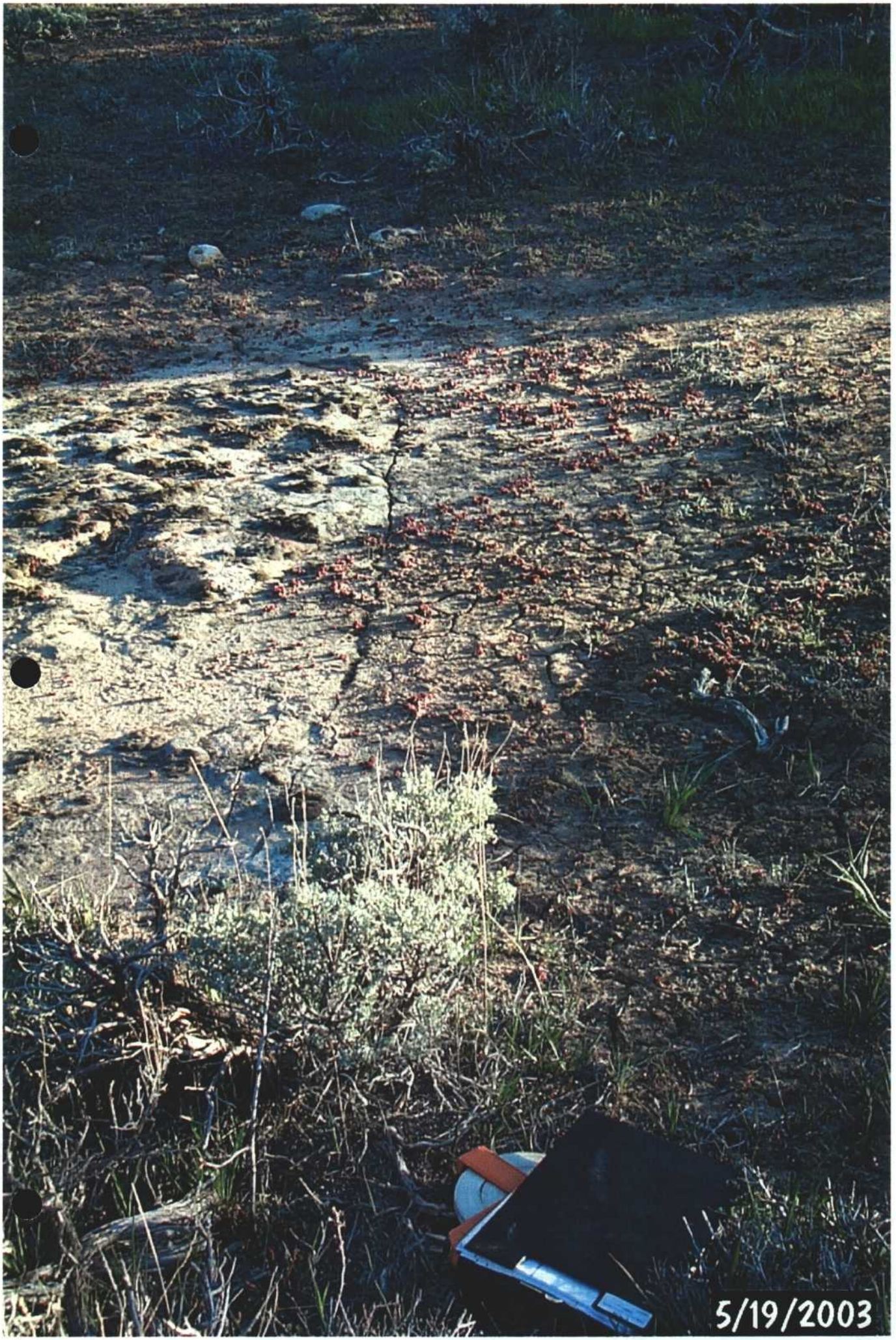
Vegetative Ground Cover (circle all that apply) - (Grass/Forbes (meadow, sparse cover), Shrubs (tall, (low,) medium), Trees (deciduous, evergreen)

GPS Coordinates: N4317682m
E470492m

Dimensions (in feet): This crack is 18 feet long and approximately one inch wide.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, (leave alone,) watch?):


5/19/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: pines bleeder **Feature #** 10

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8363 feet **Slope:** ~10 degrees

Type of Ground (circle one) - (Rock) Soil

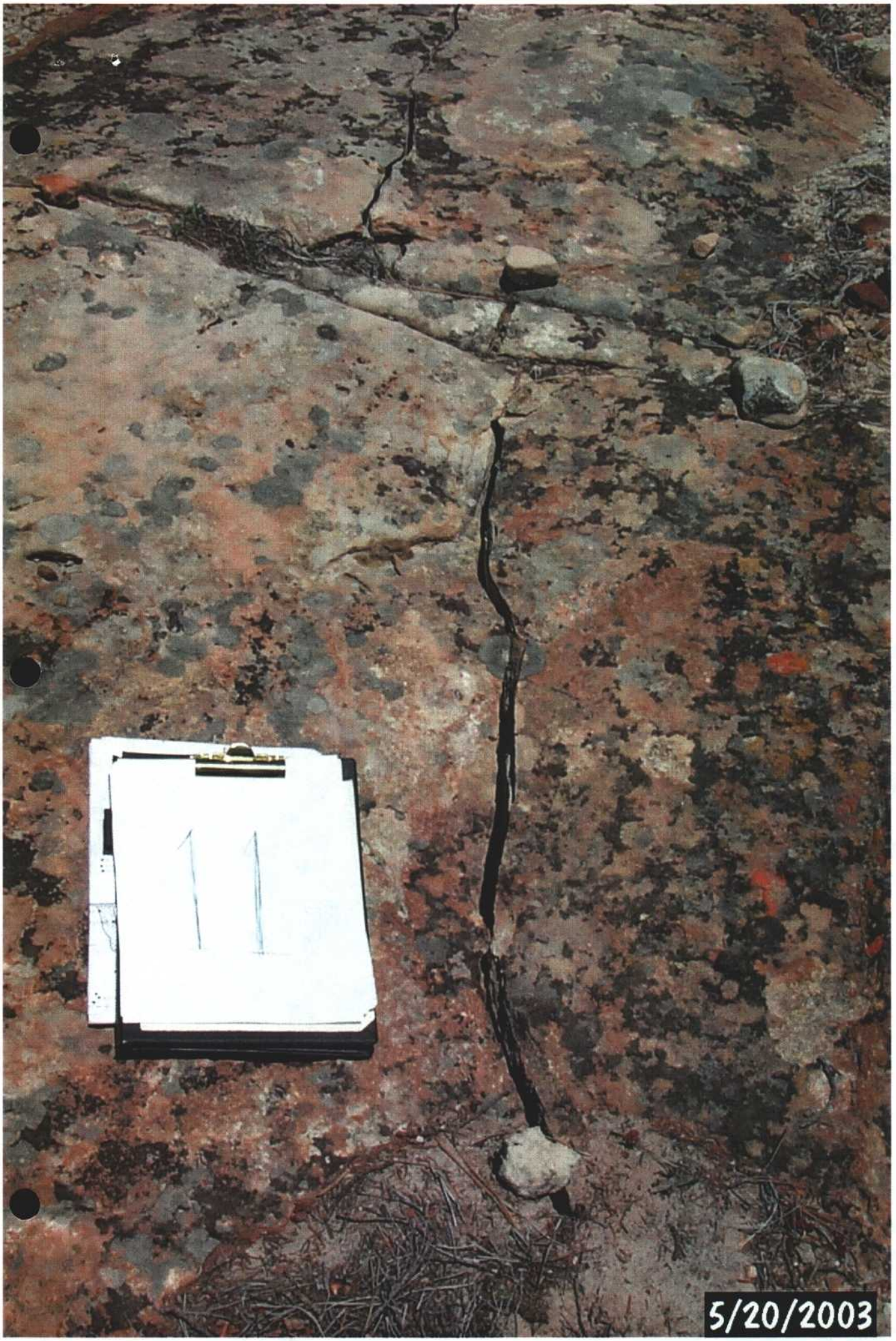
Vegetative Ground Cover (circle all that apply) - Grass/Forbes (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

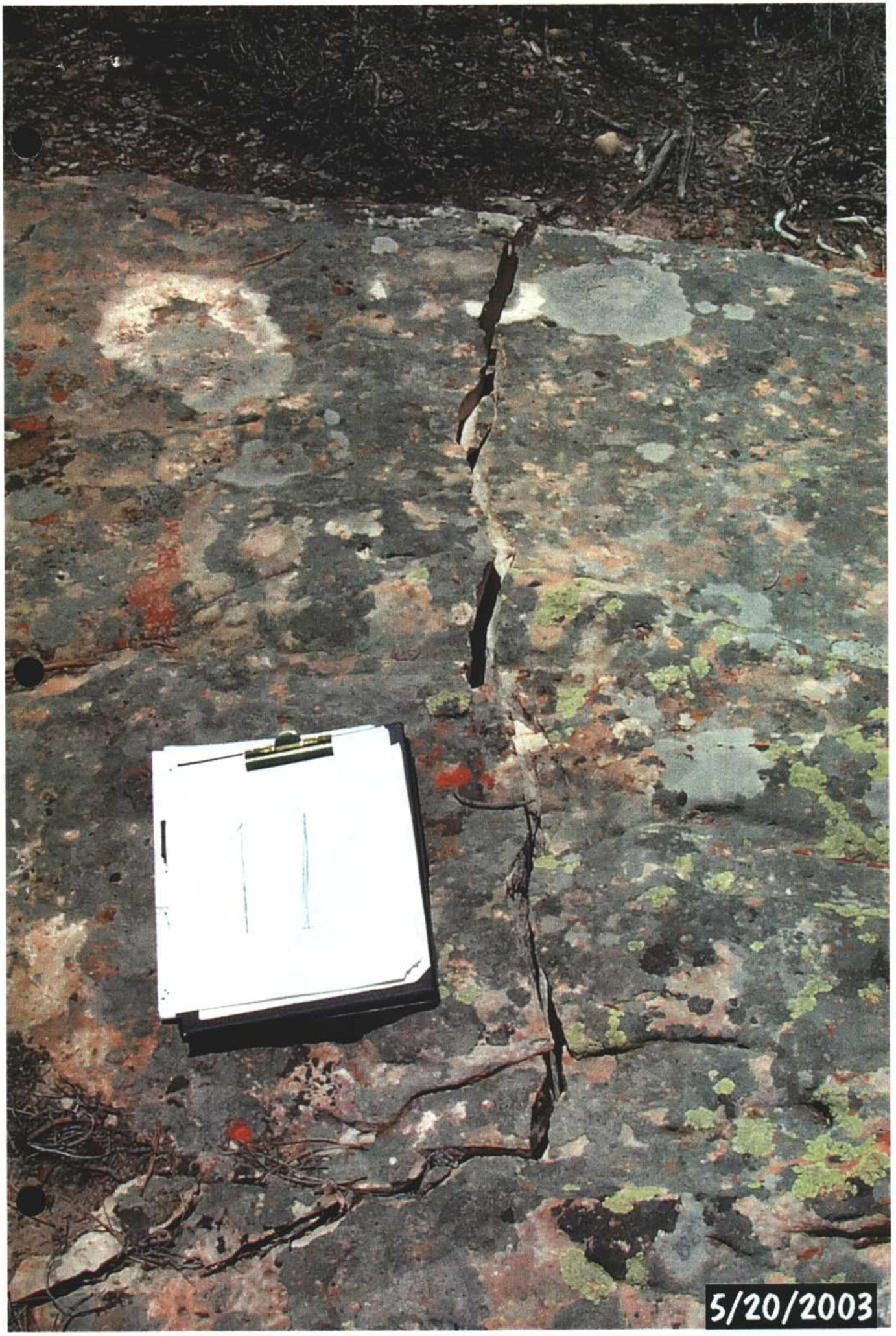
GPS Coordinates: N4315407m
E470505m

Dimensions (in feet): This crack is approximately 15 feet long, and approximately 2 inches wide.

Potential Hazards? Not really. The remaining overhang could collapse at any time, possibly endangering whatever unfortunate treasure-seeker that happens to be inside at the time.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, (leave alone) watch?):
These cracks occur directly above the Big Mac Indian Shelter.


11
5/20/2003


5/20/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: pines bleeder **Feature #** 11

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole (Heave) Escarpment Spalling

Elevation: 8389 feet **Slope:** none

Type of Ground (circle one) - (Rock) Soil

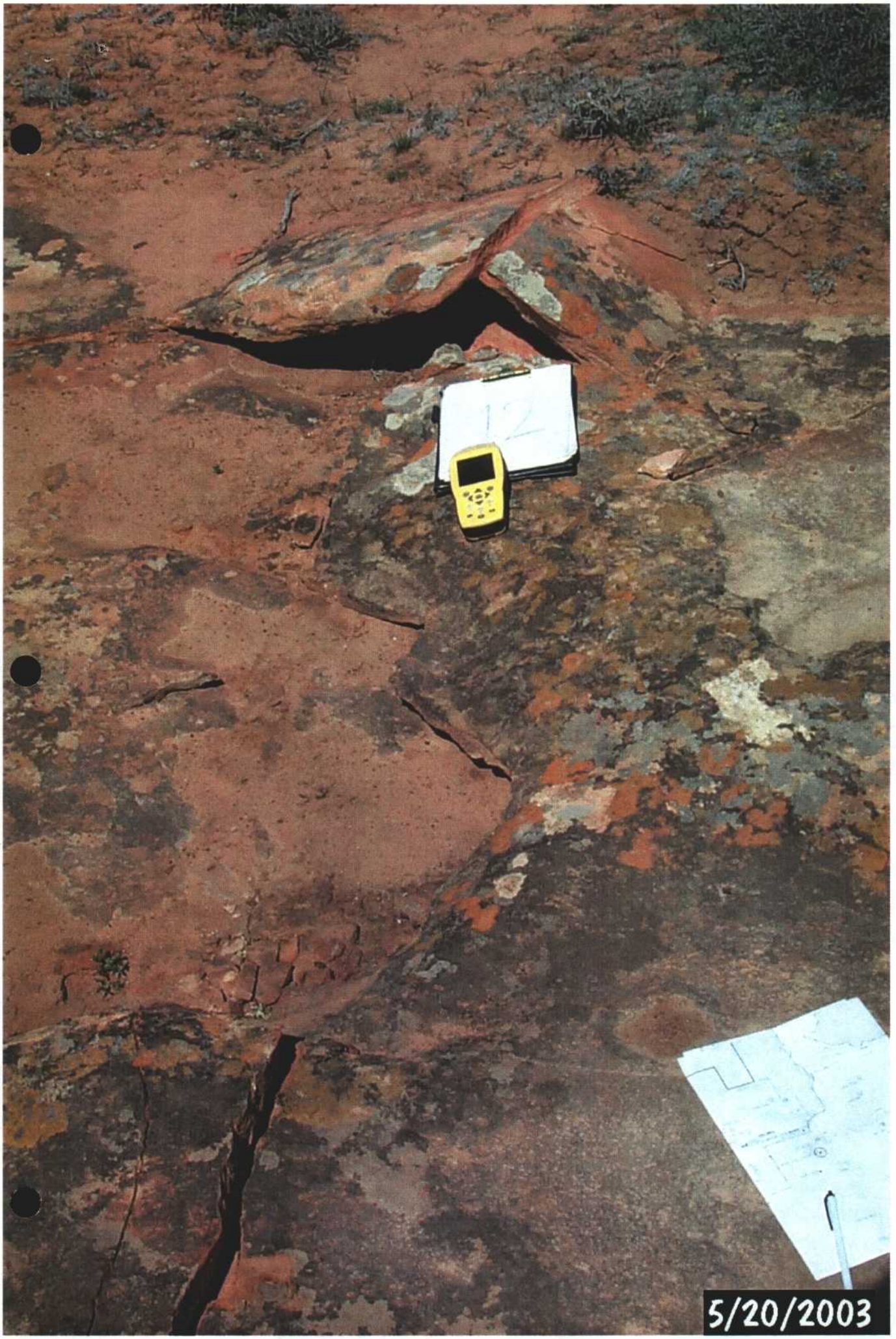
Vegetative Ground Cover (circle all that apply) - Grass/Forbes (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

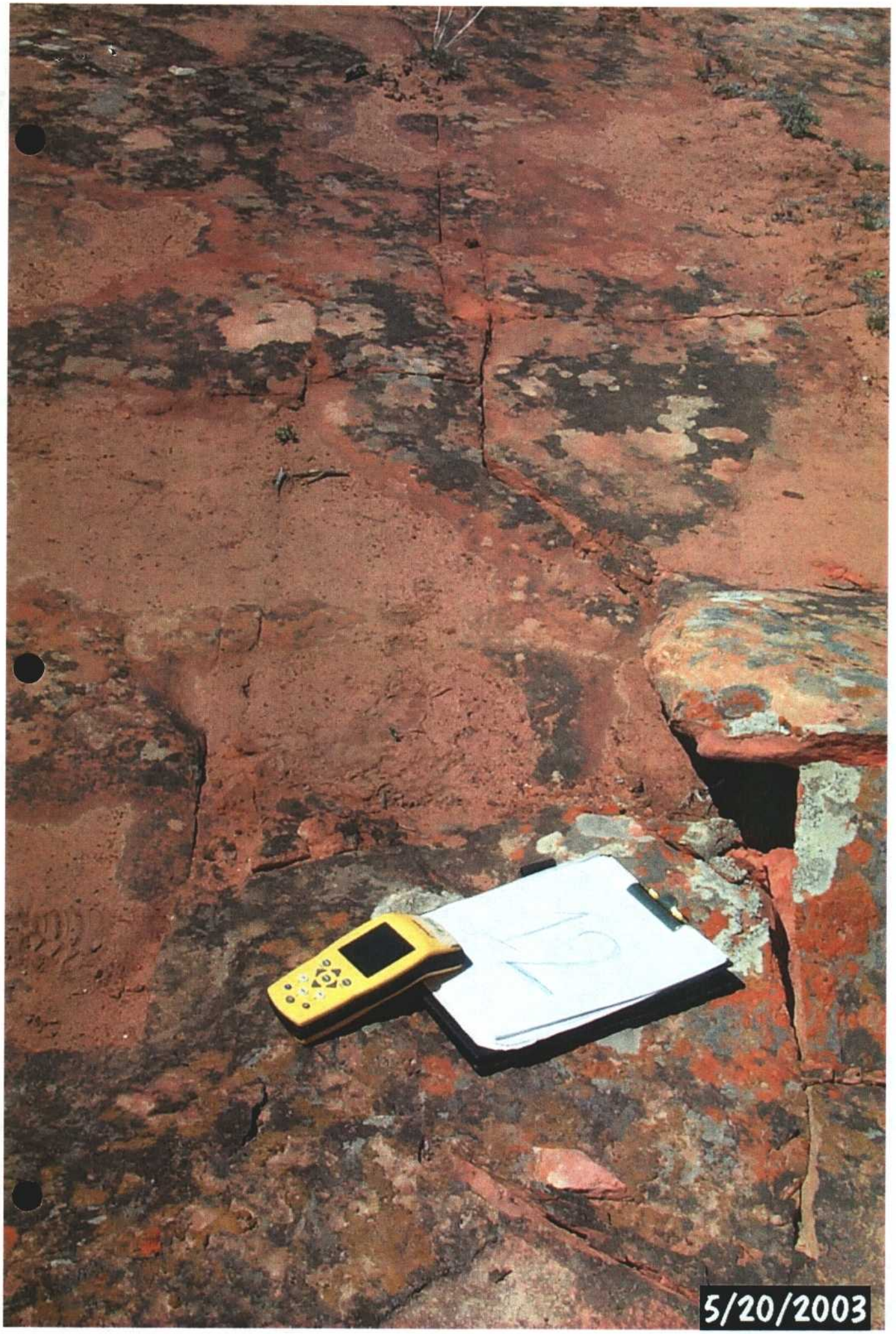
GPS Coordinates: N4315320m
E470669m

Dimensions (in feet): This crack is 20 feet long, and approximately 2 inches wide.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, (leave alone,) watch?):
Cracks are filling in.


12
5/20/2003


5/20/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: pines bleeder **Feature #** 12

Is the feature shown on survey map? no

Subsidence Feature (circle one) - Crack Sinkhole (Heave) Escarpment Spalling

Elevation: 8395 feet **Slope:** none

Type of Ground (circle one) - (Rock) (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass)/Forbes (meadow, sparse cover), Shrubs (tall, (low,) medium), Trees (deciduous, evergreen)

GPS
Coordinates: N4315398m
E470624m

Dimensions (in feet): This heave feature is 16 feet in diameter.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, (healing,) (leave alone,) watch?):
This feature is located just above the Little Mac Indian shelter.


5/20/2003


13
5/20/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: pines bleeder **Feature #** 15

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8697 feet **Slope:** ~30 degrees

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall) (low) (medium), Trees (deciduous) (evergreen)

GPS Coordinates: N4313420m
E470480m

Dimensions (in feet): This crack is 191 feet long, and up to 3 inches wide.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, (healing) (leave alone) watch?):
This crack is located on the east flank of the Wildcat Knolls, and appears to be healing well.


5/20/2003


5/20/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: pines bleeder **Feature #** 16

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8712 feet **Slope:** ~15 degrees

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

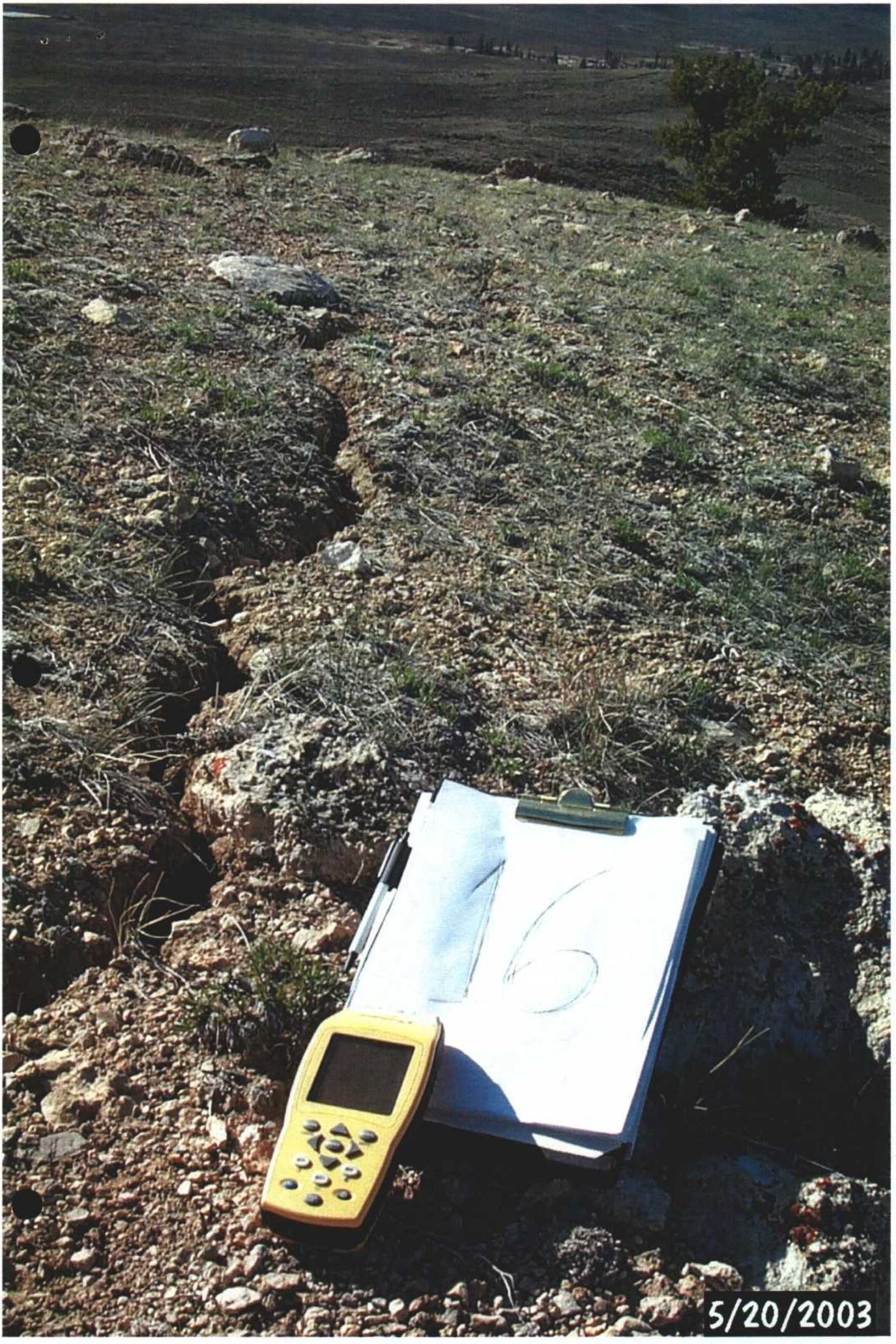
GPS Coordinates: N4313477m
E470445m

Dimensions (in feet): This crack is 148 feet long, and up to 5 inches wide.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, leave alone, (watch?)):
This crack is located on the east flank of the Wildcat Knolls, and appears to be healing well, although I would watch this one to ensure that it doesn't get as large as feature #18, which lies adjacent.

16
5/20/2003


5/20/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: pines bleeder **Feature #** 18

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8675 feet (approx.) **Slope:** variable – flat to 60 degrees

Type of Ground (circle one) - Rock (Soil)

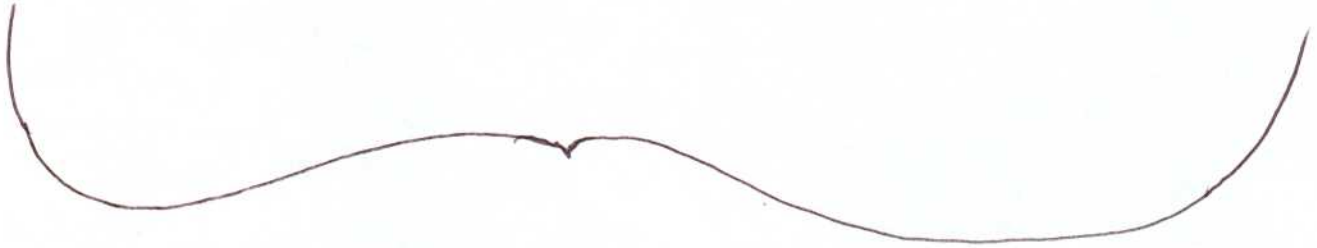
Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall, (low,) medium), Trees (deciduous, evergreen)

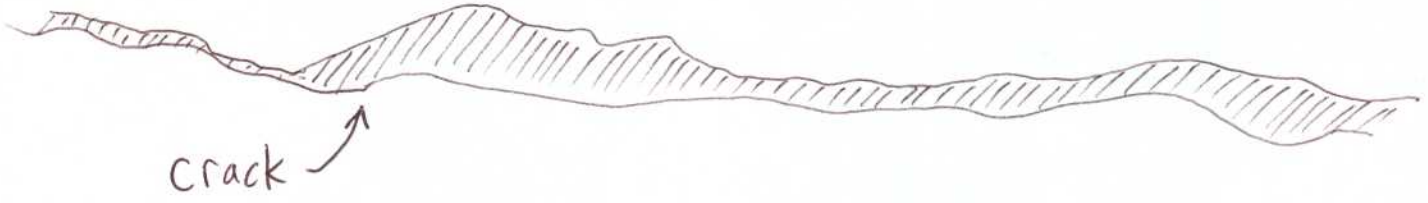
GPS Coordinates: N4313544m
E470397m

Dimensions (in feet): This crack is 500 feet long. It is up to 2 feet wide in places, with as much as 11 inches of vertical offset. It appears quite deep in most places.

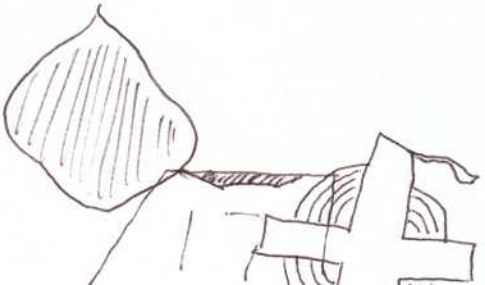
Potential Hazards? A potential threat to cattle, unwary hikers, and possibly to whatever burrowing animals that live in this area (see photos).

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, leave alone, (watch?)):
This crack is healing slowly in places. I would recommend watching this one as it may need mitigation if it doesn't heal quickly or worsens.





- animal burrow →




5/20/2003


17
5/20/2003


5/20/2003


17
5/20/2003

5/20/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: pines bleeder **Feature #** 19

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8479 feet **Slope:** none

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall, (low), medium), Trees (deciduous, evergreen)

GPS Coordinates: N4314159m
E470419m

Dimensions (in feet): This crack is 97 feet long. Width varies from 1 to 4 inches.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, (healing), (leave alone), watch?):
This crack is healing quite well.


5/20/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: pines bleeder **Feature #** 20

Is the feature shown on survey map? no

Subsidence Feature (circle one) - Crack Sinkhole (Heave) Escarpment Spalling

Elevation: 8435 feet **Slope:** none

Type of Ground (circle one) - (Rock) Soil

Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

GPS Coordinates: N4314548m
E470608m

Dimensions (in feet): This heave is 5 feet in diameter.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, (leave alone), watch?):

Document2


19
5/20/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 20 May 2003

Panel: pines bleeder **Feature #** 27, 28, 29, 30, 31

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8415 feet **Slope:** none

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall, (low) medium), Trees (deciduous, evergreen)

GPS Coordinates: N4315201m
E470536m

Dimensions (in feet): This is a series of five parallel cracks all oriented the same way. Their lengths vary from between 40 and 90 feet long, and all are between 1 and 3 inches wide. They are spaced approximately 50 feet apart.

Potential Hazards? Not apparent.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, (healing), (leave alone), watch?):
All cracks are healing pretty well.


5/20/2003

Subsidence Documentation Study
Summary Sheet

Mine Name: Sufco **Mine Number** C/041/002

Panel: 13L4E (areas 10 &11)

Feature #'s: 22, 23, 26, 32,

Date of Mining: January 1999 to August 2001

Describe the mining that took place in this area (methods, multiple seams,)
Gateroad development began in January 1999 in area 11; Longwall mining began in May 2000 through August 2001 (completing mining in both areas 10 and 11).

Subsidence Survey (methods and dates, date of subsidence):
The panels in areas 10 and 11 demonstrate a vertical displacement of up to 7 and 6 feet respectively.These measurements were recorded using current photogrammetric monitoring. These areas are considered "active" subsidence areas as displacement may still be occurring.

Describe the amount and type of subsidence reported in the Annual Report (provide reference to year)
Surface depressions and tension cracks are documented along entire length of panel, as reported in the 2001 Annual Report.

Depth of Overburden (both seams):
Between 900 and 1300 feet.

Does any subsidence feature on this panel require mitigation? If so describe.
Features 22 and 26 should be considered for mitigation as they are both quite sizeable, and have had about three years to heal with little success on their own.

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 21 May 2003

Panel: 13L4E (area 11) **Feature #** 22

Is the feature shown on survey map? yes

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8347 feet **Slope:** ~10 degrees

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass)/Forbes (meadow, sparse cover), Shrubs (tall, (low), medium), Trees (deciduous, (evergreen))

GPS Coordinates: N4315867m
E470089m

Dimensions (in feet): This crack is 99 feet long, up to 5 feet wide, and up to four feet deep.

Potential Hazards? This crack cuts through a game trail, and may be a hazard to cattle.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** ((needs work), healing, leave alone, watch?):
Taking into consideration the crack's dimensions versus how long it has had to heal I would recommend possibly mitigating this one.


21
5/21/2003


21
5/21/2003


21
5/21/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 21 May 2003

Panel: 13L4E (area 11) **Feature #** 23

Is the feature shown on survey map? yes

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8373 feet **Slope:** none

Type of Ground (circle one) - (Rock) Soil

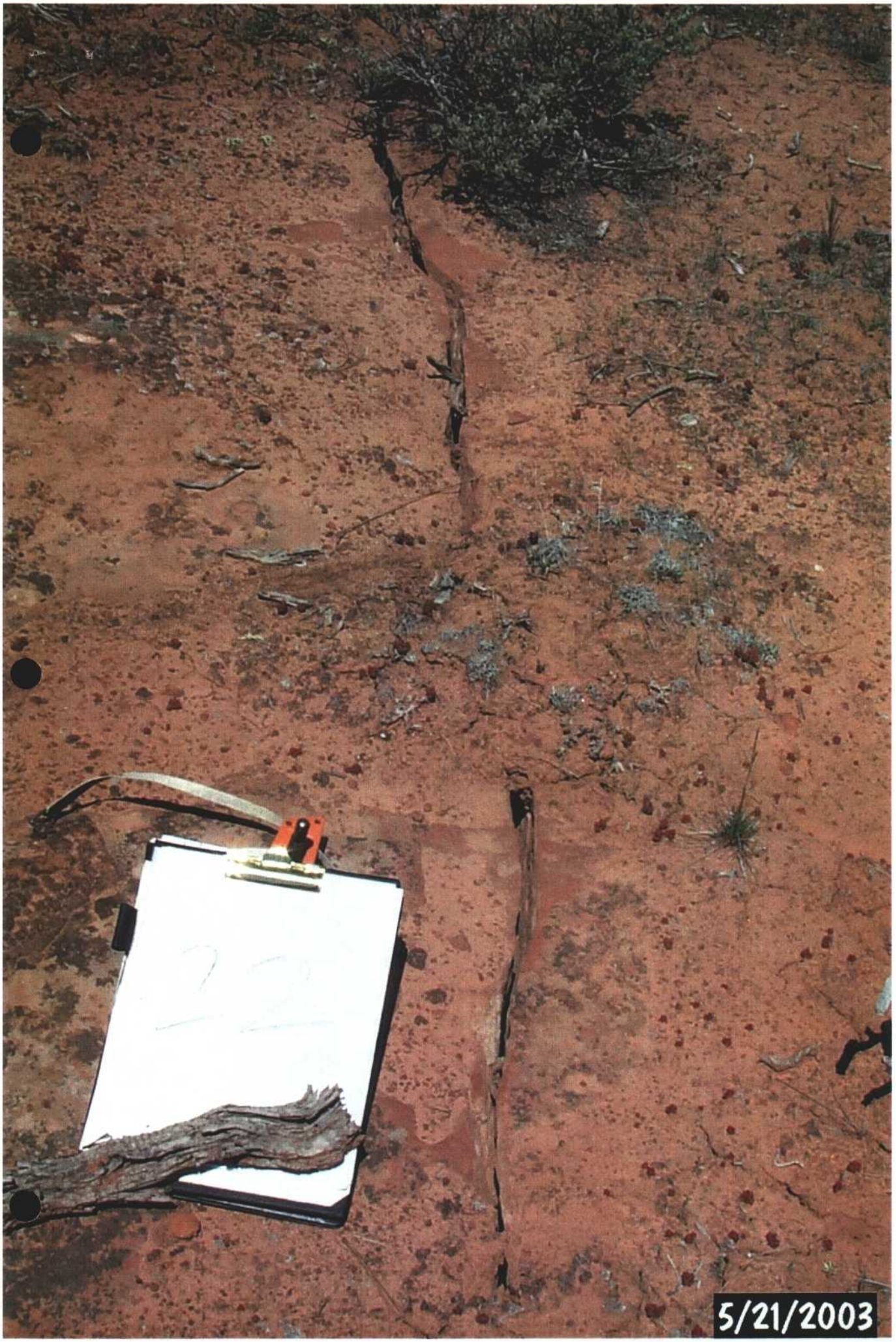
Vegetative Ground Cover (circle all that apply) - Grass/Forbes (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

GPS Coordinates: N4316022m
E470035m

Dimensions (in feet): This crack is 12 feet long, up to 1 inch wide.

Potential Hazards? None

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, (leave alone), watch?):
This crack is the largest of several cracks in this area that are healing well.


5/21/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 21 May 2003

Panel: 13L4E (area 11) **Feature #** 26

Is the feature shown on survey map? yes

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8405 feet **Slope:** none

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass)/(Forbes) (meadow, sparse cover), Shrubs (tall, (low,) medium), Trees (deciduous, evergreen)

GPS Coordinates: N4316353m
E470140m

Dimensions (in feet): This crack is 183 feet long, up to 11 inches wide, and appears quite deep.

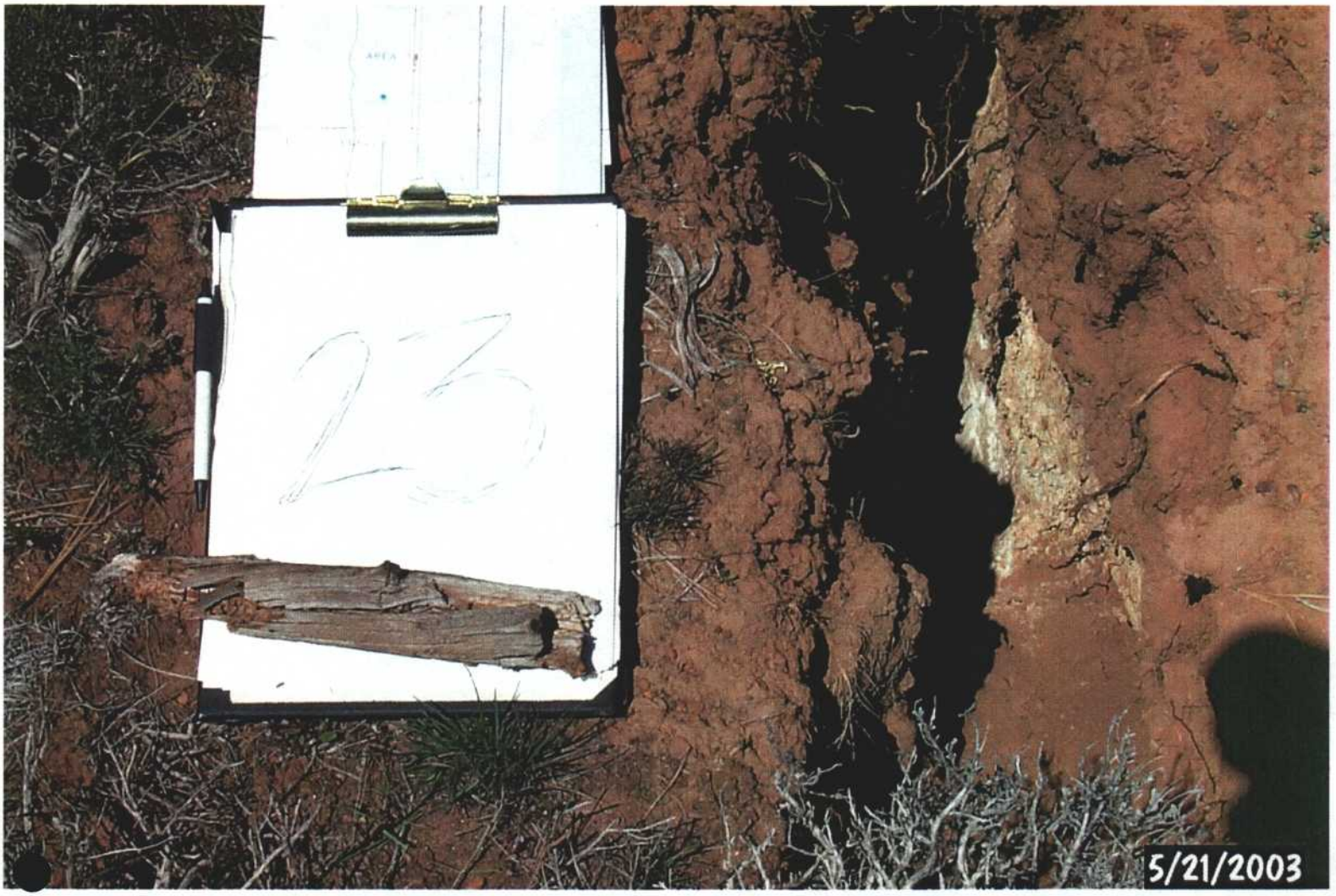
Potential Hazards? This is a very deep crack visibly – it could swallow dirt for a long time and not heal. A potential hazard to cattle.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, leave alone, watch?):
This crack runs through a dirt road. Taking into consideration the crack's dimensions versus how long it has had to heal I would recommend mitigating this one.


23
5/21/2003


5/21/2003


5/21/2003



Crack is large enough to reveal underlying bedrock

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 21 May 2003

Panel: 13L4E (area 10) **Feature #** 32

Is the feature shown on survey map? yes

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8619 feet **Slope:** negligible

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall, (low,) medium), Trees (deciduous, evergreen)

GPS Coordinates: N4312025m
E469941m

Dimensions (in feet): This crack is 159 feet long, and appears to have been a pretty wide crack when it was a crack (it is filled in now).

Potential Hazards? None.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, leave alone, watch?):
An example of a crack that has completely healed.


24
5/21/2003

Subsidence Documentation Study
Summary Sheet

Mine Name: Sufco **Mine Number** C/041/002

Panel: 6L4E

Feature #'s: 33

Date of Mining: January 1992 to June 1992

Describe the mining that took place in this area (methods, multiple seams,)
Longwall mining

Subsidence Survey (methods and dates, date of subsidence):
This panel demonstrates a vertical displacement of up to 5 feet. These measurements were recorded using current photogrammetric monitoring. This area is considered an "active" subsidence area as displacement may still be occurring.

Describe the amount and type of subsidence reported in the Annual Report (provide reference to year)
Surface depressions are documented along entire length of panel, as reported in the 2001 Annual Report. Some tension cracks are reported as well as documented cliff spalling in the southwest corner of the panel.

Depth of Overburden (both seams):
Between 700 and 1000 feet.

Does any subsidence feature on this panel require mitigation? If so describe.
Feature 33 should definitely be considered for mitigation. The area wherein this feature lies was undercut eleven years ago, and has had little success in healing on its own. This feature demonstrates potential hazards to cattle and those intrepid enough to cross it in a vehicle.

P:\GROUPS\COAL\WP\TEAMS\Subsidence\summary_sheet.doc

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 21 May 2003

Panel: 6L4E (area 10) **Feature #** 33

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8401 feet **Slope:** negligible

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass) (Forbes) (meadow, sparse cover), Shrubs (tall, (low) medium), Trees (deciduous, evergreen)

GPS Coordinates: N4313045m
E467398m

Dimensions (in feet): This crack is 230 feet long, up to four feet wide, and appears very deep.

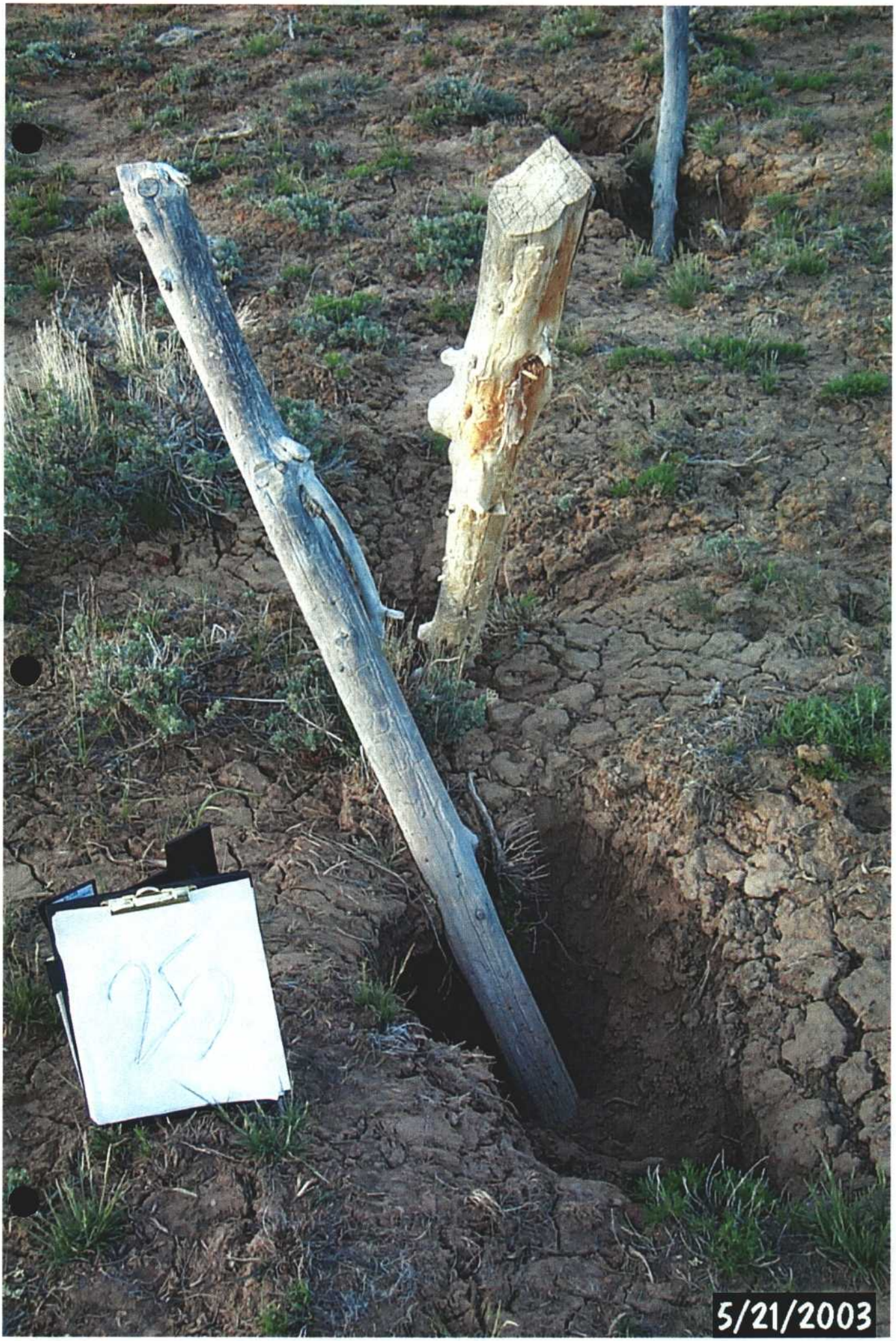
Potential Hazards? Possible hazards to cattle, hikers, summer interns, semis, etc. Cuts through a road, so it's possibly a hazard to anyone daring enough to drive over it (see photos).

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work,) healing, leave alone, watch?):
There is some healing along its length, however mining occurred here over ten years ago. I would recommend at least mitigating the part that runs through the road.


5/21/2003


5/21/2003


5/21/2003


5/21/2003

Subsidence Documentation Study
Summary Sheet

Mine Name: Sufco **Mine Number** C/041/002

Panel: 2L4E

Feature #'s: 34, 35, 36, 37, 38, 39

Date of Mining: Began in June 1983, and was sporadic to 1992

Describe the mining that took place in this area (methods, multiple seams,)
Continuous miners were used with extraction ratios over 80% and mining heights of 10 feet.

Subsidence Survey (methods and dates, date of subsidence):
This panel demonstrates a vertical displacement of up to 5 feet. These measurements were recorded using current photogrammetric monitoring. This area is considered a "dormant" subsidence area, as displacement is no longer occurring.

Describe the amount and type of subsidence reported in the Annual Report (provide reference to year)
Surface depressions are documented along entire length of panel, as reported in the 2001 Annual Report. One tension crack was reported and no cliff spalling was documented despite the fact that almost half of the panel extends out into Quitchupah Canyon.

Depth of Overburden (both seams):
Between 600 and 1000 feet.

Does any subsidence feature on this panel require mitigation? If so describe.
Features 35, 36, and 37 could possibly be candidates for mitigation. Mining occurred in this area between one and two decades ago, and yet these features are still quite sizeable. Even so, it is questionable whether these features are hazards to man or beast.

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 22 May 2003

Panel: 2L4E (area 8) **Feature #** 34

Is the feature shown on survey map? no

Subsidence Feature (circle one) - (Crack) Sinkhole Heave Escarpment Spalling

Elevation: 8305 feet **Slope:** negligible

Type of Ground (circle one) - (Rock) Soil

Vegetative Ground Cover (circle all that apply) - Grass/Forbes (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

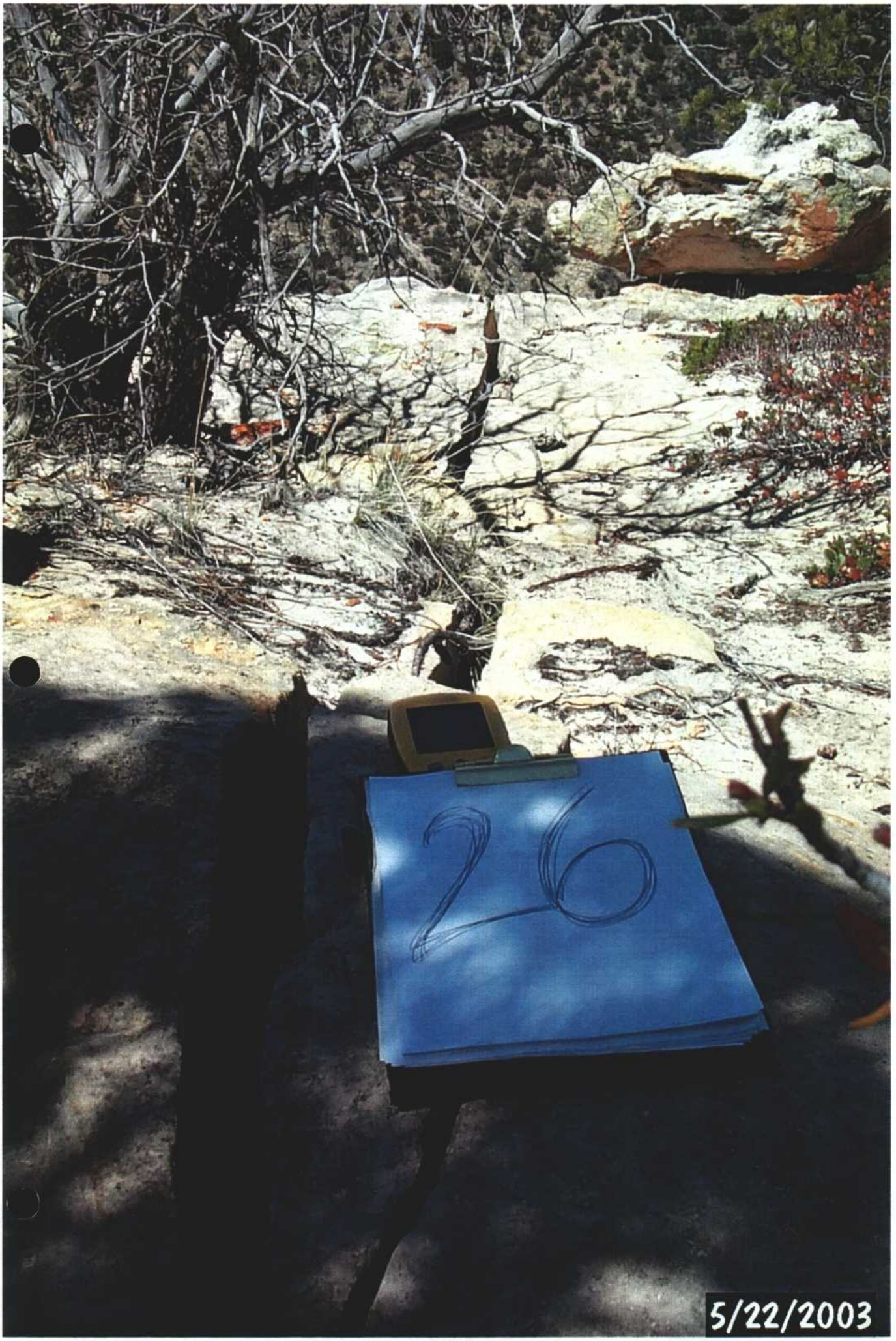
GPS Coordinates: N4312922m
E466551m

Dimensions (in feet): This crack is 28 feet long, and up to four inches wide.

Potential Hazards? none.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, (leave alone) watch?):

Document2


26
5/22/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 22 May 2003

Panel: 2L4E (area 8) **Feature #** 35, 36, 37

Is the feature shown on survey map? no

Subsidence Feature (circle one) - Crack (Sinkhole) Heave Escarpment Spalling

Elevation: 8294 feet **Slope:** negligible

Type of Ground (circle one) - Rock (Soil)

Vegetative Ground Cover (circle all that apply) - (Grass) Forbes (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

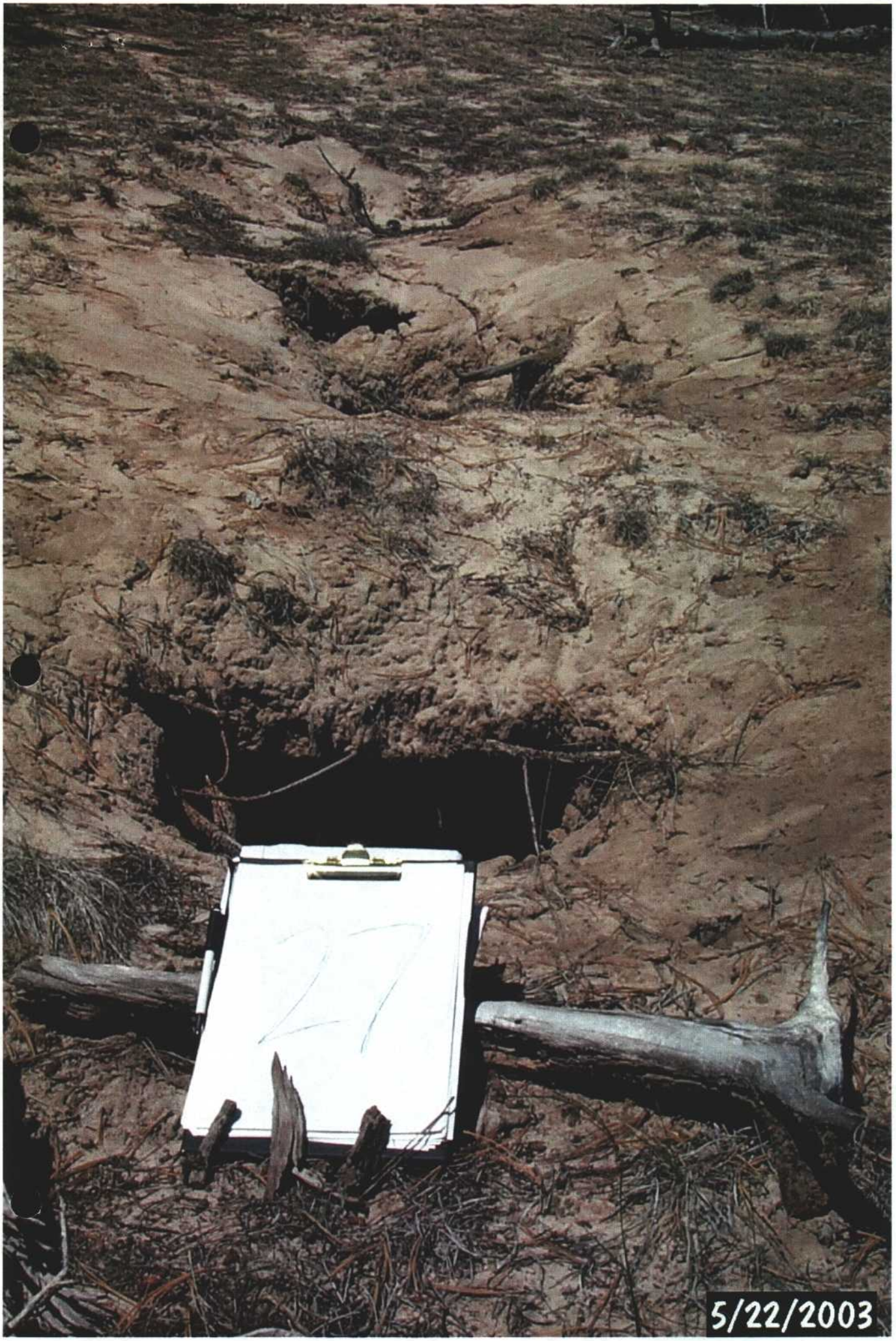
GPS Coordinates: N4312969m
E466617m

Dimensions (in feet): This is a series of sinkholes all in a row which suggests that this may have been a crack at one time but has not fully healed. The sinkholes all average about 30 inches in diameter, spaced about 2 feet apart.

Potential Hazards? In this case it is difficult to justify mitigation because the area doesn't appear to be frequented by cattle, and it is quite remote and away from any roads. Notwithstanding, the holes are quite deep.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, leave alone, (watch?)):
These sinkholes occur on the crest of a ravine, which unlike a stream channel does not receive a steady stream of sediment flowing across its length. Under these conditions, it could be a very long time before these sinkholes fill up completely.


5/22/2003


5/22/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 22 May 2003

Panel: 2L4E (area 8) **Feature #** 38

Is the feature shown on survey map? no

Subsidence Feature (circle one) - Crack Sinkhole Heave Escarpment (Spalling)

Elevation: 8308 feet **Slope:** negligible

Type of Ground (circle one) - (Rock) Soil

Vegetative Ground Cover (circle all that apply) - Grass/Forbes (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, (evergreen))

GPS Coordinates: N4313001m
E466658m

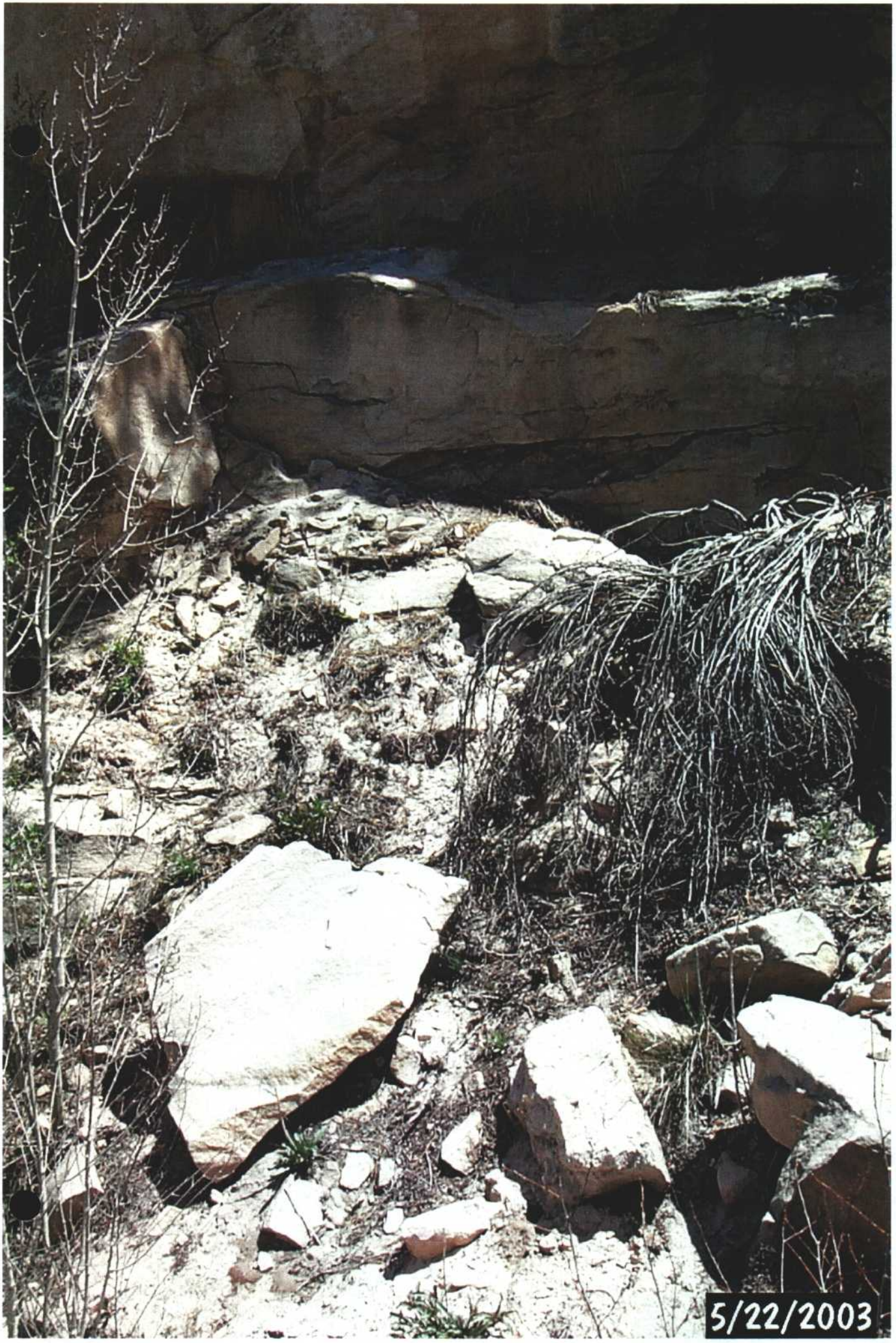
Dimensions (in feet): This is a fifty foot section of cliff spalling.

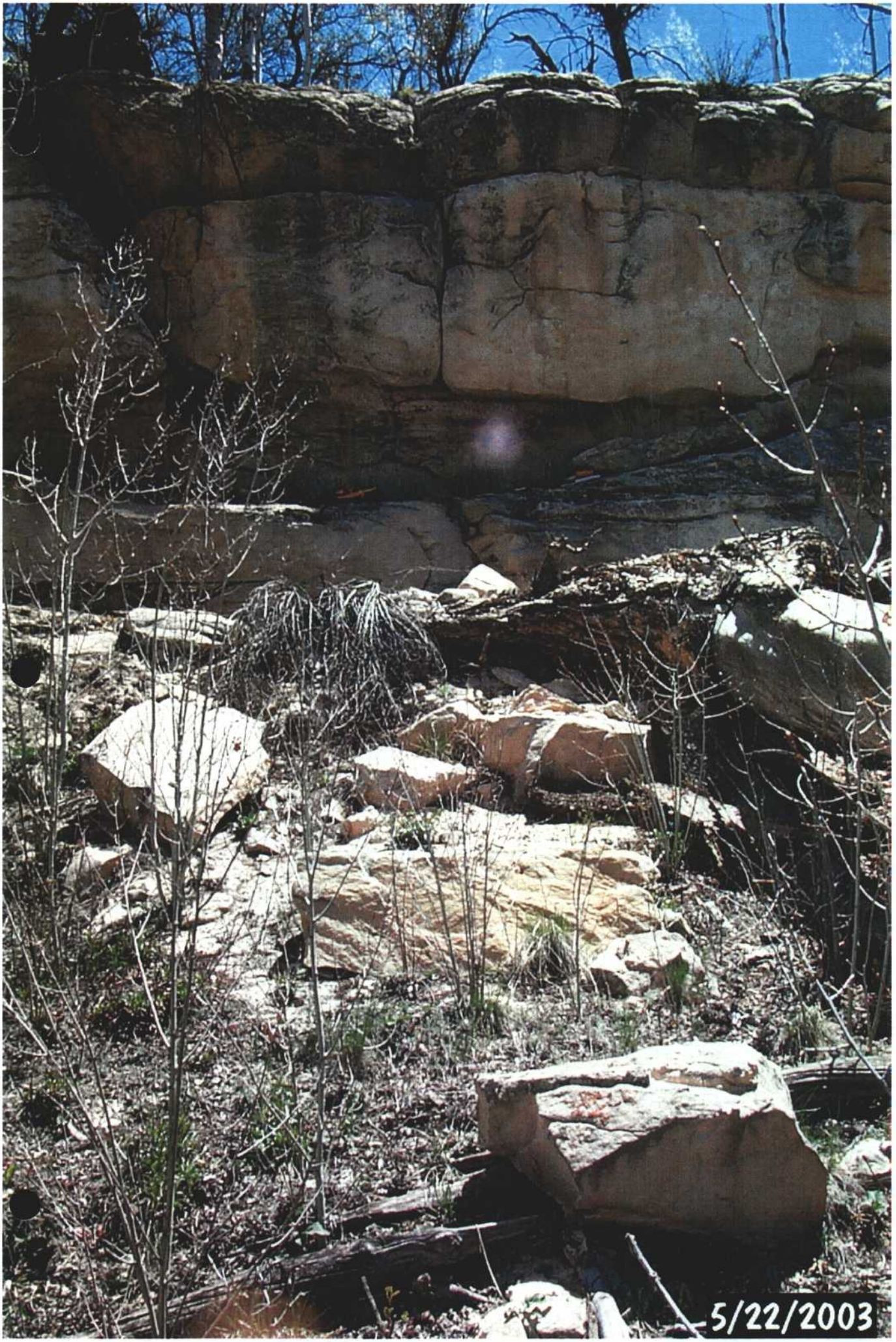
Potential Hazards? None.

Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, (leave alone), watch?):
A large Ponderosa Pine was growing up through cracks in the cliff face. When spalling occurred, the rocks supporting the tree's roots broke loose, and the tree fell.


5/22/2003


5/22/2003


5/22/2003


5/22/2003

Subsidence Documentation Study
Data Sheet

Mine Name: Sufco **Date:** 22 May 2003

Panel: 2L4E (area 8) **Feature #** 39

Is the feature shown on survey map? no

Subsidence Feature (circle one) - Crack Sinkhole Heave Escarpment (Spalling)

Elevation: 8287 feet **Slope:** negligible

Type of Ground (circle one) - (Rock) Soil

Vegetative Ground Cover (circle all that apply) - Grass/Forbes (meadow, sparse cover), Shrubs (tall, low, medium), Trees (deciduous, evergreen)

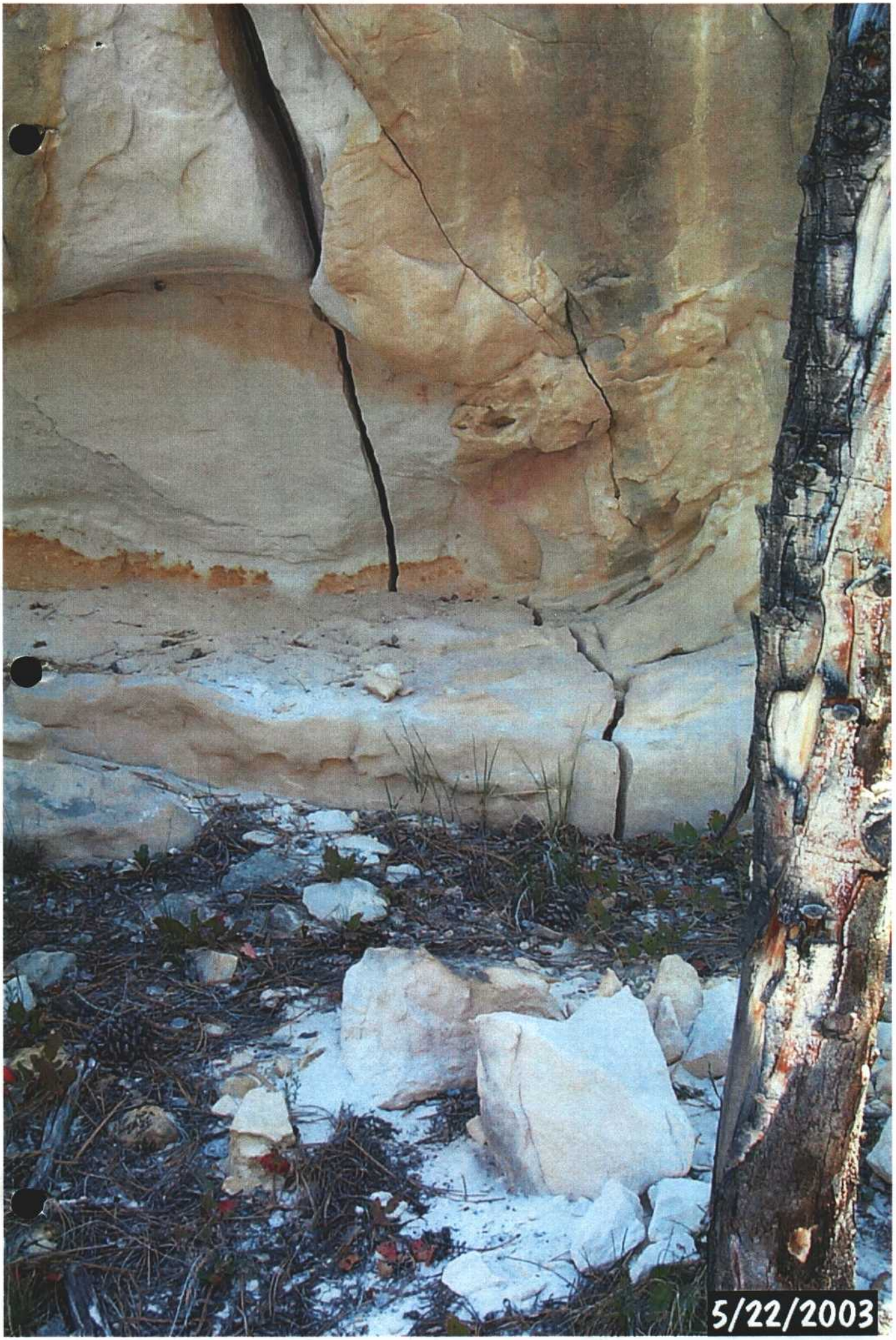
GPS Coordinates: N4313061m
E466626m

Dimensions (in feet): Approximately an eighty foot crack in the cliff face, with minor spalling.

Potential Hazards? None.

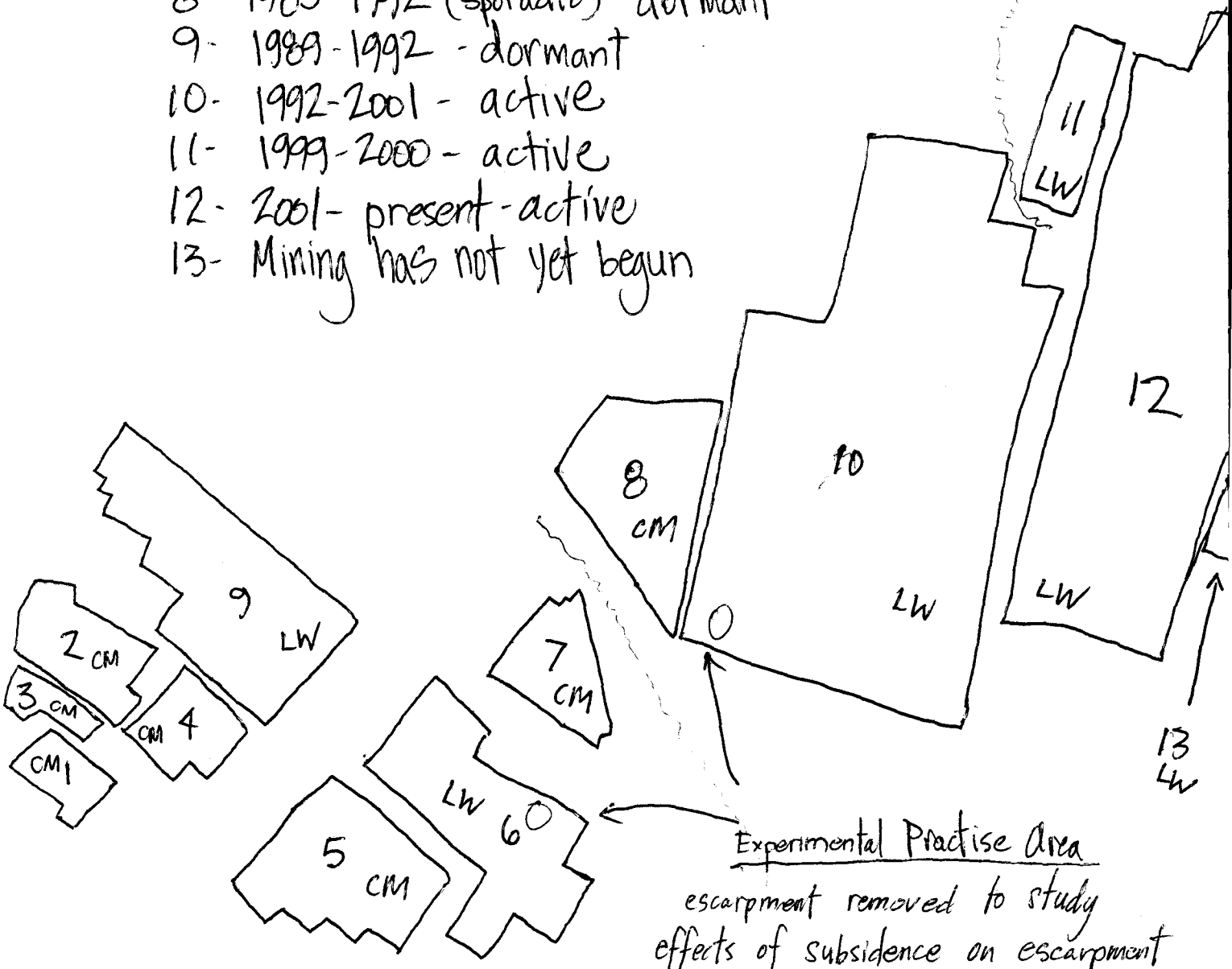
Other Comments (seeps, stream channel, archeological, eagle nest) **and Recommendations** (needs work, healing, (leave alone) watch?):


5/22/2003


5/22/2003

Dates- Subsidence Status

1- 1976-1979 dormant
2- 1980- [redacted] 1984 dormant
3- 1980-1983 dormant
4- 1980- 1985 dormant
5- 1978-1981 dormant
1st Longwall 6- 1985-1990 dormant
7- flooded in 1984 - planned as "No subsidence zone" - dormant
8- 1983-1992 (sporadic) - dormant
9- 1989-1992 - dormant
10- 1992-2001 - active
11- 1999-2000 - active
12- 2001- present - active
13- Mining has not yet begun



Experimental Practise Area

escarpment removed to study effects of subsidence on escarpment

Some cliff spalling occured in panel 6 in 1988 above 3 room & pillar panels
cliff spalling & tension cracks occurred in panel 10 above longwall panel

Canyon Fuel – SUFCO Mine 2002 subsidence impacts from undermining cultural sites 42SV2434 Little Mac and 42SV2433 Big Mac located in the center of Longwall panel 1LPE.

42SV2434 Little Mac

This site was undermined on 3/26/02. This cultural site had numerous natural rock failures before it was undermined (Fig. 1 & 3). Subsidence impacts were about what was anticipated when the monitoring program was initially set up. Subsidence impact resulted in the overhanging rock on the right side, that already had a large crack on the backside, breaking loose and falling in. The overhanging rock on the left side rolled into the opening (Fig. 2 & 4). The overhang on the left side could have already been cracked similar to the right side since it broke across on the same crack line. How much the site has subsided is not know yet. The subsidence will be measured over the next few weeks.

Figure 1 Before-May 6, 2000

Figure 2 After-April 23, 2002

Figure 3 Before-May 6, 2000

Figure 4 After-April 23, 2002

42SV2433 Big Mac

This site was undermined on 3/22/02. Subsidence impacts were not what was anticipated when the monitoring program was initially set up. The overhanging rock had some natural small cracks but was not broken up as much as some of the other sites and it was felt that this site would probably not be impacted by subsidence (Fig. 5 & 7). Subsidence impact resulted in the roof rock cracking in the center of the site and breaking off on the right side (Fig. 6 & 8). This is similar to what happen at the 42SV2492 150-Acre site in 2000 but not as severe. This site has not been surveyed since it subsided to determine how much the site has subsided.

Figure 5 Before-May 6, 2000

Figure 6 After-April 23, 2002

Figure 7 Before-May 6, 2000

Figure 8 After-April 23, 2002

THE FOLLOWING MAP(S) IS KEPT WITH THIS REPORT;

SUFCO MINE